Communications of the Association for Information Systems

Volume 47 Article 55

12-10-2020

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Recommended Citation

Magnusson, J., Polutnik, L., & Ask, U. (2020). Semi-confusing Information Systems Revisited: The Role of Inefficiencies in Enacting Ambidexterity. Communications of the Association for Information Systems, 47, pp-pp. https://doi.org/10.17705/1CAIS.04721

Communications of the Association for Information Systems

Research Paper DOI: 10.17705/1CAIS.04721 ISSN: 1529-3181

Semi-confusing Information Systems Revisited: The Role of Inefficiencies in Enacting Ambidexterity

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Abstract:

Forty years ago, Bo Hedberg and Sten Jönsson proposed the notion of semi-confusing information systems as a desired state for organizations operating in dynamic environments. At its core, the idea posits that efficiency alone cannot ensure long-term success but that organizations also require a certain amount of inefficiency. These ideas resonate in the growing literature on organizational ambidexterity that has deemed the dynamic balancing of exploration and exploitation a prerequisite for long-term performance. We use the design characteristics of semi-confusing information systems as a lens to analyze secondary data on a case of new product development in a global, automotive organization. We found that inefficiencies in the new product-development process correspond to the proposed design characteristics of semi-confusing information systems, which illustrates a new perspective on the role that inefficiencies play in organizations' efforts to enact ambidexterity. The identified inefficiencies manifested in unsanctioned repertoires, which resulted in increased variety. In addition, we found the level of compliance with semi-confusing information systems characteristics to impact both an organization's ambidextrous balance and the degree to which an organization enacts ambidexterity in a decentralized way.

Keywords: Inefficiency, Ambidexterity, Enactment, New Product Development.

This manuscript underwent peer review. It was received 03/19/2019 and was with the authors for 14 months for three revisions. Anders Hjalmarsson served as Associate Editor.

1 Introduction

As Schumpeter (1942) has noted, organizations remain perpetually stuck in a present reality where they optimize operations while thinking strategically and focusing on the future. Previous research has identified tradeoffs between the two objectives (Adler et al., 2009; Hannan & Freeman, 1977; Luger, Raisch & Schimmer, 2018; MacDuffie, 1997; Salovaara, Lyytinen & Esko, 2019; Suarez, Cusumano, & Fine, 1996) and proposed various perspectives such as dynamic capabilities (Teece, Pisano, & Shuen, 1997; Liang, Wang, Xue, & Ge, 2017), strategic agility (Lee, Sambamurthy, Lim, & Wei, 2015) and organizational ambidexterity (March, 1991) to circumvent them.

Hedberg and Jönsson (1978) presented one largely overlooked contribution that addresses this tradeoff. They defined a notion called "semi-confusing" as a sign of merit for information systems. According to Hedberg and Jönsson (1978), organizations that act in an unstable environment need destabilization more than stabilization (i.e., they need systems designed to afford doubt rather than certainty). Such organizations would benefit more from pursuing systems that allow for ambiguity and uncertainties rather than clarity and perfect knowledge. To put it bluntly, organizations that act in dynamic environments need a certain amount of inefficiency.

This line of argument regarding the need for inefficiency is also a tenet of the organizational ambidexterity literature (March, 1991; Raisch & Birkinshaw, 2008). According to this research stream, organizations continuously balance exploitation and exploration. Following Benner and Tuschman (2003) and Xue, Ray, and Sambamurthy (2012), we equate exploitation with efficiency through seeing it as efforts to continuously improve existing services and processes, and where we equate exploration with innovation through identifying opportunities to acquire and develop radically new knowledge and service concepts.

Recent findings from the organizational ambidexterity field stress that balancing exploration and exploitation is, in essence, dynamic (i.e., ambidexterity is not a fixed state) and that organizations need to approach it from an enactment rather than an organizational-design perspective (Luger, Raisch & Schimmer, 2018; Zimmermann, Raisch & Cardinal, 2018). Reverberating the literature in the IS control field and its recurring calls for a focus on control enactment rather than configuration (Wiener, Mähring, Remus, & Saunders, 2016; Remus, Wiener, Saunders, & Mähring, 2020), we find a need for researchers to conduct additional research into how organizations enact ambidexterity.

In this exploratory study, we investigate an alternative approach to understanding how organizations enact ambidexterity. This alternative approach re-imagines inefficiencies not as bugs but rather features in ambidexterity enactment. As we argue, inefficiencies play a potential role in balancing, yet the previous literature has largely not considered this perspective. Referring to Hedberg and Jönsson (1978), we develop an investigatory framework to identify and analyze inefficiencies. Rather than perceiving these inefficiencies as suboptimal states, we study how they may act as a semi-confusing information system's (SCIS) design characteristics and constitute mechanisms for how organizations may enact ambidexterity in dynamic environments (Hedberg & Jönsson, 1978). In particular, we address the following research question (RQ):

> **RQ**: How can a semi-confusing information systems perspective on inefficiency help explain how organizations enact ambidexterity?

With this study, we respond to Stokes et al.'s (2015) call for empirical research that examines the boundaries between explorative and exploitative behavior and to Zimmermann et al.'s (2018) and Luger et al.'s (2018) dynamic approach to ambidexterity and their call for further studies on how organizations enact ambidexterity. We contribute to research by offering an alternative perspective on inefficiencies in order to aid future studies on how organizations enact organizational ambidexterity. This perspective attributes inefficiencies with a new role in balancing exploration and exploitation and offers a potential avenue for future studies.

We operationalize this study by analyzing secondary data (Bishop, 2016) that we collected during a transformation of the new product development (NPD) initiative at Rolling Thunder, a large and well-established global automotive firm. The automotive industry has and continues to undergo significant and disruptive changes due to new technologies (Pavlinek, 2020) and changes in the way customers use transportation and mobility services (Grieger & Ludwig, 2019). In this highly dynamic environment, NPD plays a critical role (Kyriazis, Massey, Couchman, & Johnson, 2017; Massey & Kyriazis, 2007; Mathew, Joglekar, & Desai, 2010). We participated in the NPD transformation initiative at Rolling Thunder and

focused on identifying inefficiencies in the organization's existing NPD process. The resulting analysis from the research team's work helped the organization redesign its NPD process in 2017.

The paper proceeds as follows: in Section 2, we review the literature on inefficiency and organizational ambidexterity and revisit Hedberg and Jönsson's (1978) work. In Section 3, we present the underlying study and the secondary data analysis. In Section 4, we present the identified inefficiencies in the company's NPD process as SCIS design characteristics. In Section 5, we discuss our findings and how our study informs research in organizational ambidexterity. Finally, in Section 6, we conclude the paper.

2 Literature and Conceptual Background

2.1 Inefficiency and Organizational Ambidexterity

Previous studies have largely treated inefficiency as fallout from suboptimization. The underlying notion of efficiency (i.e., the relationship between input and output in which an increase in the output/input ratio equates to an increase in efficiency (Brunsson, 2017)) is laden with deterministic assumptions. Various researchers, including those in neo-classical (Schumpeter, 1942) and behavioral economics (Cyert & March, 1963; Thaler & Sunstein, 1999), have long dismissed the idea that there exists complete intentionality in terms of which outputs organizations prefer in the short and long-term. .

Treating efficiency and inefficiency as a dichotomy has pushed researchers into a situation in which they invariably regard inefficiency as something that organizations should avoid and inherently bad and efficiency as something that organizations should desire and a state in which organizations maximize, measure, and control operational performance. The organizational ambidexterity perspective fundamentally challenges this interpretation (Gaim & Wåhlin, 2016; Xue et al., 2012). Instead of viewing efficiency as the optimal outcome for organizations focused on achieving the best results from exploiting existing opportunities (Birkinshaw, Zimmermann, & Raisch, 2016), this research stream treats efficiency as intermittently a dichotomy and a dualism (Ask, Magnusson, & Nilsson, 2015; Farjoun, 2010). Organizations need to be at the same time able to deliver efficiency and innovation (exploitation and exploration). In addition, increased dynamism in the business environment would lead to an increased need for innovation (i.e., diminishing returns on increased efficiency (Ahuja & Lampert, 2001)) and increasing returns on organizations' ability to balance efficiency and innovation at the same time (Luger et al., 2018; Zimmermann et al., 2018).

From this perspective, one may juxtapose inefficiency (if we accept the dichotomy stance) against efficiency and interpreted as a proxy for innovation (for a more nuanced elaboration, see Benner & Tushman, 2003). The literature surrounding organizational slack reiterates the perspective (Bourgeois, 1981; Mousa, Chowdhury, & Gallagher, 2017; Stock, Greis, & Fischer, 2018; Tan & Peng, 2003) in which slack can be considered as a vestige of innovation.

In a recent study on innovation practices at the Swedish Tax Agency, Magnusson, Koutsikouri, and Päivärinta (2020) identified slack in the form of what they refer to as shadow innovation (i.e., unsanctioned innovation activities) that constituted 20 percent the agency's total IT expenditure. While this study's definition of shadow innovation can be directly interpreted as system inefficiency, it also at the same time provides organizations' with an opportunity to achieve long-term relevance and legitimacy through what may be referred as unsanctioned buffering (Thompson, 1967). Other studies focused on unsanctioned innovation activities have built on the notion of skunkworks based on work at Lockheed Martin in the 1990s (Miller, 1995; Rich & Janos, 2013). Here, an organization depends on unsanctioned innovation for its long-term success, yet the negative fallout that results when the innovation does not become institutionalized, identified, or scaled (Huang, Henfridsson, Liu, & Newell, 2017)can be directly defined as optimization that leads to sub-optimal outcomes.

To summarize, the necessity for organizations to simultaneously exploit and explore strengthens their need to address the negative consequences that result from solely pursuing efficiency. When an organization pursues innovation (exploration) with inefficiencies, an increase in efficiency may directly result in a decrease in innovation and, therefore, hinder long-term organizational sustainability. Hence, when studying organizational ambidexterity, we need to understand inefficiency in a more nuanced way.

2.2 Semi-confusing Information Systems Revisited

Hedberg and Jönsson (1978) approached the role of information systems from the perspective that such systems may not adequately support an organization's long-term intent. Rather than seeing information systems merely as stabilizers, they opened up the possibility to explore a new role of information systems as beneficial destabilizers. According to Hedberg and Jönsson (1978, p. 47):

> *Current information—and accounting—systems do more to stabilize organizations than to destabilize them. They filter away conflicts, ambiguities, overlaps, uncertainty etc. [sic] and they suppress many relevant change signals and kill initiatives to act on early warnings.*

As Table 1 shows, Hedberg and Jönsson (1978) offer design characteristics that they couple with the needs they define as common for organizations in dynamic environments. Based on purposefully sampling the last ten years of the management literature, we include examples of approaches and/or cases that illustrate how contemporary practice incorporates the design characteristics. As one can see, the need for what Hedberg and Jönsson called "semi-confusing" remains important and relevant in practice.

Table 1. Some SCIS Design Characteristics (Adapted from Hedberg & Jönsson, 1978, p. 61)

Design characteristic	Implication / description	Examples
Variety in communication	Organizations need to establish multiplicity in communication (with redundancies and alternatives constantly evolving) rather than formalized routines for decision making and reporting.	Social media and the transparent enterprise (McAfee, 2006). Role ambiguities, short-circuiting levels or groups, and collective intelligence (Bonabeau, 2009). Netflix used a contest to design and develop a better recommendation engine (Bonabeau, 2009).
Variety in perception	Organizations need to base their analyses on individual or group perceptions rather than on global templates and uniform reference models.	Interactive data visualization based on cognitive profile (Dilla, Janvrin, & Raschke, 2010). IBM has applied design thinking to not only product development but also business design (Kolko, 2015). Samsung incorporated strategic understanding into its design team processes and decentralized strategy execution (Yoo & Kim, 2015).
Variety in evaluation	Objectives and evaluation criteria need to be ambiguous and pluralistic rather than comparable (over time and space) and clear.	Deloitte took a new approach to compensation with a shift from day-to-day to quarterly and per-project "performance snapshots" (Buckingham & Goodall, 2015). Scheduled end-of-day written reflections and communication of said reflections to colleagues drove performance at a Bangalore call center (Beshears & Gino, 2015). Algorithms outperformed human judgment by 25 percent in recruitment (Soll, Milkman, & Payne, 2015).

Hedberg and Jönsson (1978) called for increased variety as a path to destabilization. Through introducing (and accepting) variety in communication, perception, and evaluation, an organization may demonstrate increased ambivalence and uncertainty in management. In turn, this increased ambivalence and uncertainty in management can lead to increasing pluralism and expanded analysis repertoires, which may result in increased capabilities for competing in a dynamic environment.

3 Method

3.1 Empirical Selection

We build on a case study of the NPD process in Rolling Thunder that we conducted in the period from 2014-2016. A public and well-established automotive manufacturing firm, Rolling Thunder employed approximately 100,000 employees in the studied period. Rolling Thunder spent about 5.5 percent of its net revenue on research and development (R&D). At the time, it conducted most of its R&D in house rather than outsourcing it. We selected the organization's NPD process as a study object and assumed the NPD process requires organizations to carefully balance efficiency and innovation. Spending too much on innovation may theoretically result in increased time to market and sunk costs. On the other hand,

spending too much time and effort on efficiency may decrease proper preparedness and innovativeness to face competition and achieve sustainable advantage.

The automotive industry continues to go through significant and disruptive changes due to the new technologies such as electrification, self-driving cars, and telematics (Athanasopoulou, de Reuver, Nikou, & Bouwman, 2019). The industry is also experiencing significant changes in consumer demand due to shifting preferences in favor of purchasing services rather than opting for the traditional automobile ownership model (Grieger & Ludwig, 2019). Consumers have changed the way they use transportation and mobility services, and automotive organizations have started to address organizational challenges to prepare for selling services as opposed to selling products (Genzlinger, Zejnilovic, & Bustinza, 2020; Svahn, Mathiassen, & Lindgren, 2017). Overall, these disruptions have resulted in more competitive and dynamic automotive markets. Additionally, these changes have fundamentally disrupted older manufacturing organizations that have traditionally had a strong engineering culture as their foundation (Pavlinek, 2020). In summary, the more dynamic global automotive industry faces pressure to reorient business models, improve responsiveness to changes in customer value and overall markets, and align various stakeholders around the same goals.

Rolling Thunder and other automotive organizations have responded to these pressures by focusing on NPD and its importance for building competitive advantage and financial success (Petrillo, De Felice, & Zomparelli, 2019). At the time of the study, Rolling Thunder also lagged behind other known automotive brands in terms of an adequate and updated portfolio of products. Therefore, the organization had begun to focus on refreshing its products and introducing new and updated models and to position itself in premium markets. The company sold relatively few cars compared to market leaders (e.g., Toyota), and its new vehicle sales accounted for a significant part of its overall sales, which further confirms its need bring updated models to market.

NPD encompasses many activities and processes that span an entire organization and require collaboration and cooperation across different functions (Kyriazis et al., 2017; Massey & Kyriazis, 2007; Mathew et al., 2010). Due to disruptions and dynamics in the automotive industry, NPD has taken on a heightened importance and a critical factor for whether an organization will succeed in the future (Petrillo et al., 2019). The leadership team at Rolling Thunder expressed a need to more broadly understand the organization's NPD function and its inefficiencies as part of a transformation initiative to address changes in the industry environment. Accordingly, we chose to examine SCIS at Rolling Thunder, an organization in which the dynamics in the automotive industry presented an opportunity to study a heightened importance of NPD.

3.2 Data Collection

We studied the potential to improve and transform the NPD process at Rolling Thunder. While researchers can use many different approaches to gather case data, we used the methodology that Yin (2017) developed. At its core, Yin's approach focuses on careful documentation before, during, and after a study. Additionally, when researchers build documentation on well-defined protocols and research questions, the case methodology can provide reliable findings and, thus, support theory building (Eisenhardt, 1989).

Our data collection comprised semi-structured interviews, meetings, and workshops. In addition, we used a secondary qualitative data-analysis approach (Bishop, 2016; Heaton, 2008) and identified and collected documents about and related to the NPD process. Since we had access to the various functional areas of the organization, we could secure all necessary documentation to study NPD design characteristics and activities across all relevant stakeholders. We used these documents to perform text analysis.

The research team was very familiar with Rolling Thunder given that the team had collaborated with the organization on various previous research projects. Based on this collective experience and understanding, the research team developed contextual knowledge that proved valuable in interpreting the collected data (Yin, 2017). The research team had direct access to two key actors who coordinated the project. The steering group comprised six C-level managers who, in close collaboration with the research team, defined the project's scope. In addition, the steering group and the researchers jointly identified decision makers with key NPD roles to participate in the interviews. The research team also had access to ten additional C-level managers who oversaw the line organization functions and had leadership roles in the NPD transformation initiative.

The research team conducted 37 individual semi-structured interviews (51.4 hours of data) based on a defined protocol and with open-ended questions. Each interview lasted from 60 to 120 minutes. Most interviews took place between August, 2014, and March, 2015. The interviewees represented a cross-section of responsibilities across key functions involved in NPD at Rolling Thunder (see Table 2). We placed special attention on assuring that they incorporated critical stakeholders from R&D, marketing, and manufacturing functions. We recorded all interviews and meetings and transcribed them verbatim (917 pages).

Table 2. Interviews Conducted

	Marketing	Product strategy	Design	R&D	Manufacturing	HR	Finance
Vice president	0	2	1	3	2	2	0
Director	4	0	0	4	1	0	2
Manager	4	1	0	2	2	0	0
Operations	2	0	0	5	0	0	0
Total	10	3	1	14	5	2	2

The research team collaborated with the steering committee and received extensive access to follow all aspects of the NPD transformation initiative and shape the project scope along the way. We presented and discussed the project and our ongoing learnings based on interviews and documents collected in 11 meetings and 4 workshops. Each workshop lasted two to three hours, was recorded, and notes were transcribed. Additional insights and documents resulted from the workshops, such as identification of obstacles in the NPD processes (e.g., communication gaps and organizational challenges). The research team and the steering committee discussed these additional findings to assess their usefulness and whether they would affect how the organization managed its NPD. Close collaboration with the organization provided valuable contextual knowledge and decreased the risk regarding ethical concerns relating to the re-use and reporting of data (Bishop, 2016).

Next, in collaboration with the steering committee, the research team identified NPD information gaps and collected additional data to close the gaps where needed. We received additional internal documentation and protocols pertaining to the NPD processes and communication from 14 interviewees/respondents.

3.3 Analysis Method

We applied the SCIS design characteristics (see Table 1) from Hedberg and Jönsson (1978) as a framework to analyze the data that we] collected at Rolling Thunder about its NPD. Through re-interpreting inefficiencies that we identified in the NPD process as a means to achieve variety, we analyzed how they acted as destabilizers and not solely as suboptimal states. The analysis involved three sequential steps.

3.3.1 Step 1: Data Exploration

The interview data and documents about NPD did not lend themselves to statistical testing. Instead, we sought to use empirical observations and text analysis from the case study research in combination with existing literature to understand the role that inefficiencies played in the NPD at Rolling Thunder in a more nuanced way and to support theorizing. We proceeded to analyze the NPD interview text data to further explore SCIS design characteristics (variety in communication, variety in perception, and variety in evaluation) as Hedberg and Jönsson's (1978) define them. The text data analysis provided the basis to understand emerging themes in the interviews (Silverman, 2015).

3.3.2 Step 2: Coding

We employed text and word-count analysis to identify key themes and perspectives in the NPD process at Rolling Thunder (Braun & Clarke, 2006). We repeatedly read and coded the interview data (from 37 interviews) using ATLAS.ti software. We developed the initial descriptive results based on 48 codes with 1,378 quotations and 3,814 instances of word use. We developed protocols and guidelines for coding the

interview data. We present sample codes and the synonyms that we used to catch when a specific code occurred in Table 3.

Table 3. Sample of Codes, Descriptions, and Synonyms

Name of code	Description	Synonyms
Competitors	Names of competitors	Market dynamics, market share erosion, reference price, price changes, price competition, benchmark, competitive behavior
Customer	Every time the word customer is used or customer definition in different contexts	Customer, customer trends, customer data, customer behavior, customer definition, customer feedback, everything recorded that includes the word customer
Value	Everything recorded that includes value, both as customer value but also value in other terms	Value creation, value definition, value perception, brand value, brand identity, perceived value, creating and capturing value via processes for customers, creating value for the company by lowering costs, decreasing lead-time.
Business perspective	Business case, product strategy	Business plan, car project/program, commercial focus, business group, business driven, business logic
Price	Every time price is mentioned	Price, pricing methodology, value-based pricing, reference price, willingness to pay, ability to pay, pricing options, transactions price, price information, price elasticity, price list, price mix, price position, pricing perspective, price point, list price, pricing policy.
Attributes / features	Various product attributes, characteristics/features	Safety, luxurious, innovative design, quality
Option packages	Every time option packages are mentioned by respondents	Right option packages, trim level, seat comfort, climate comfort, bundled features, options offered to customers as add-ons
Functions	Various functions in the organization	Marketing, finance, product strategy, product design, manufacturing, R&D
Revenue	Discussing price and volume with resulting revenue implications	Revenue target, sales target, sales, marketing goals, revenue management, revenue perspective
Cost	Anytime the word cost is used	Cost focus, product cost, material cost, standard cost, pure cost, examples of indirect and direct cost, direct impact on cost, cost target, cost reduction, cost awareness, cost modeling, cost plus, cost perspective
Profitability	When profitability is discussed directly and indirectly or in relation to cost and revenue	Profit, profitability, lowering costs and improving profitability, improving revenue and profitability, profit margin, profitable product line
Finance	Anytime the word finance is used by the respondent	Financial, finance, finance director, budgeting, commercial program, financial amount, financial perspective, financing a project
Volume	Anytime the word volume is used by the respondent	Volume target, volume expectations, trends in sales volume, national sales, sold cars in different geographies/by model, volume planning, volume mix
Balance	Balancing between value and cost, creating value for the customer and the organization	Balancing, financial balance, balance in volume, as well as balancing efforts (balance between value, cost, and time), responsibility for balancing features to capture customer value and creating value for the company, balancing processes

After coding, we performed a code-concurrence check. We eliminated all irrelevant and duplicate codes and included only the unique codes in the final analysis. From this process, we reduced the number of codes to 14 (competitors, customer, value, business perspective, price, attributes/features, option packages, functions, revenue, cost, profit/profitability, finance, volume, and balance). We also included additional codes that pertained to “information gaps” and “informational flows”.

In identifying the 14 codes, we identified various functional and stakeholder perspectives and their roles in the NPD process as important. For example, we expected that the finance department would focus on finances, profitability, and the business perspective of the new product/service initiative. We also expected that the text analysis emerging from the interviews with the marketing division employees would be focused on customer value and competitors. In performing the text and word-count analysis, we analyzed how the occurrence of the selected 14 codes differed across various functions and functional areas. By doing so, we could better understand various perspectives, concerns, and potential gaps and inefficiencies in NPD at Rolling Thunder.

We conducted the secondary data analysis (Bishop, 2016) in two steps. First, we identified how often SCIS design characteristics occurred in the interview data. Second, we categorized the identified accounts into the design characteristics categories from Hedberg and Jönsson (1978). We supplemented the word-count interview data with workshop notes, internal documentation, and protocols to analyze the identified design characteristics in the organization. These additional documents provided important information about the various contexts across different functions and their varied concerns (Yin, 2017). In Table 4, we show some inefficiencies/design characteristics and code examples and identify how these were applied to the level of analysis (by function or by role of the respondent).

Table 4. Design Characteristics, Data, and Level of Analysis

Inefficiency/design characteristic	Examples of codes highlighting design characteristics	Level of Analysis
Information gaps	Information sharing, information systems	By function
Asymmetric information flows	Industrial vs. commercial system	By function
Conceptual fluidity	Customer value	By function
Value ambivalence	Use of “customer” across functions	By role and by function
Distorted responsibility	Value/cost balancing	By function
Lack of accountability	Gates in a stage-gate system	By gate status and time

3.3.3 Step 3: Validation

Two members of our research team re-read the text and checked the codes to ensure coding consistency. In addition, these two researchers coded five interviews in parallel. Their results showed high consistency (> 95%) in coding. Afterwards our research team and steering committee members at Rolling Thunder jointly reviewed the codes, we obtained a consensus that the selected codes described the relevant themes that emerged from the interviews.

4 Results: Semi-confusing Design Characteristics at Rolling Thunder

We present the results in relation to the inefficiencies we identified in the NPD process at Rolling Thunder. In Table 5, we organize the inefficiencies following Hedberg and Jönsson’s (1978) SCIS design characteristics.

Table 5. Identified Inefficiencies and Their Links to the Design Characteristics of SCIS

Design characteristics	Description	Identified inefficiencies
Variety in communication	Organizations need to establish multiplicity in communication (with redundancies and alternatives constantly evolving) rather than formalized routines for decision making and reporting.	Information gaps Asymmetric information flows
Variety in perception	Organizations need to conduct analyses based on individual or group perceptions rather than on global templates and uniform reference models.	Conceptual fluidity Value ambivalence
Variety in evaluation	Objectives and evaluation criteria need to be ambiguous and pluralistic rather than comparable (over time and space) and clear.	Distorted responsibility Lack of accountability

4.1 Variety in Communication

4.1.1 Inefficiency 1: Information Gaps

First, in the word-count analysis, we identified information gaps across all functional areas in the organization. As Table 6 shows, the research and development (R&D) and manufacturing functions reported information gaps the most frequently, while the marketing and product strategy functions reported them the least frequently. More than half the respondents (54%) mentioned that they experienced information gaps in their decision making.

Table 6. Gaps in Information Sharing at Rolling Thunder by Functional Area

Function	Information gap (%)
Marketing	30% (10)
Product strategy	33% (3)
R&D	79% (14)
Manufacturing	67% (6)

The following quotes with two managers provide further support for the respondents' need for additional information in their decision making:

> *The valuable customer information doesn't reach the Product Strategy.* (Director, R&D)

> *We definitely miss information about the customer, and that's why we do our own customer studies when we are able to.* (Manager, R&D)

These reported gaps illustrate initial concerns in the organization regarding the availability of appropriate information for decision making and, as a result, existence of potential inefficiencies. In general, when an organization keeps its NPD process intentionally ambiguous to accommodate changes in the customer value and competitive environment, then one can anticipate that various stakeholders need another source of information to understand how to design new products. Information gaps may result in delays due to the need for additional time and effort to gather data, complete tasks, and make decisions, or they may lead to critical product-development functions using inadequate or dated information to make NPD-related decisions.

4.1.2 Inefficiency 2: Asymmetric Information Flows

In order to better understand how information flows impacted all relevant areas of the organization, we further explored the magnitude and direction of the information flows.

At Rolling Thunder, the product strategy function referred to the NPD business case owner. In this role, the product strategy function defined products and all the NPD-related processes; it served as a bridge between the commercial (marketing) and industrial (R&D and manufacturing) functional areas. The R&D function at Rolling Thunder included product design as well. The product strategy function also defined and monitored the benchmarks (e.g., gates) that needed to be reached at every NPD stage. Using the documentation that pertained to the processes and protocols that facilitated information sharing across the organization, we laid out the NPD framework (see Figure 2). Next, we analyzed interview data by performing an interview text analysis in which we focused on counting "information gaps". Other words in our preliminary text analysis, such as information, input, gaps, interaction, strongly correlated with the phrase "information gaps".

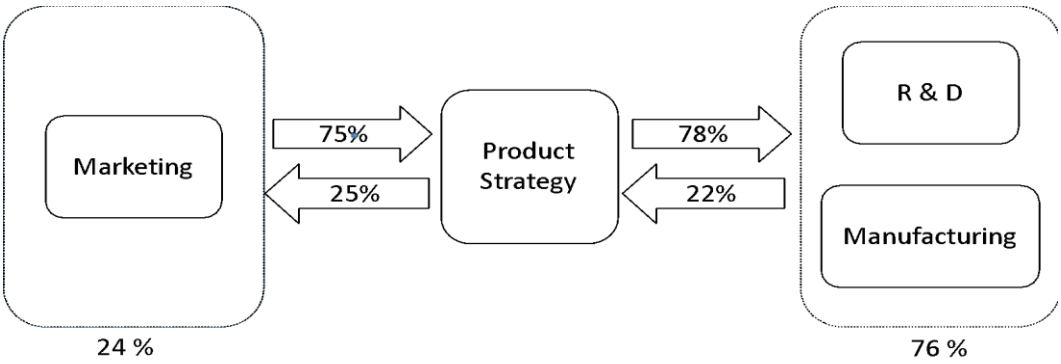

Figure 2. Direction of Information Flows and Information Sharing in the Organization

In Figure 2, we incorporate the word-count analysis data and identify the absolute number of internal documents and protocols shared across functions at Rolling Thunder. The word count analysis of documents between the R&D and manufacturing functions identified that "information gaps" occurred in 76 percent of all instances, while the same wording occurred in only 24 percent of all instances in marketing function. Further, in analyzing the total number of documents shared across functional areas, we found that the largest percent of the overall document sharing occurred between product strategy and R&D and manufacturing functions (78%) and between marketing and product strategy (75%). In contrast, we found the industrial system (R&D and manufacturing) and marketing to share information the least frequently (22% and 25%, respectively) according to the total documents all functions shared. Our interview data shows multiple cases of gaps in information sharing. For example, according to the Vice President of Manufacturing at Rolling Thunder: "Sometimes the communication between purchasing and the project isn't good enough, and we risk buying things that in the end are too expensive to actually put in the product".

These results show that the NPD process (from commercial/marketing to industrial/manufacturing systems) displayed predominantly feedforward rather than feedback information flows. Furthermore, they show that R&D, product design, and manufacturing functions, seemed to be more removed from timely customer and marketing data. Given the NPD process's design, these functional areas have a higher likelihood to receive information rather than co-create new products and affect the conversation regarding NPD.

Table 7. Analysis of Documents Facilitating Information and Knowledge Sharing

Connections between functions	Total documents (as a %)
Product strategy and R&D	16.45%
Marketing and product strategy	15.13%
Manufacturing and R&D	8.22%
R&D and marketing	6.91%
Design and product strategy	6.25%

Additionally, analyzing the total number of documents, our analyses showed that 16.45 percent of all documents facilitated information and knowledge sharing between the product strategy and R&D functions. When we explored direct communication between the marketing and R&D functions, the number of shared documents decreased significantly. Our interview data further indicate significant frustration, especially in the R&D function, regarding the quality and timeliness of information that the product strategy and marketing functions supplied, which included few opportunities to participate in the NPD discussions. More automated document/information flows in the NPD process and specific opportunities for collaborative value co-creation processes could have helped decrease information gaps in the NPD process and align the relevant stakeholders around common goals.

4.2 Variety in Perception

4.2.1 Inefficiency 3: Conceptual Fluidity

We next performed a word-count analysis on the interview data to understand how the various functions used words pertaining to customer value. In analyzing how respondents used the word "value" was associated with two distinct contexts, we found 43 percent of the word's use applied to customer value and 40 percent of the word's use was associated with attributes/features. This finding shows that the focus on value varied greatly across functions at Rolling Thunder. Value occurred most frequently in the marketing function and least frequently in the R&D function. On the other hand, "attributes" and "features" most frequently occurred in the R&D, design, and product strategy functions. As Figure 3 shows, marketing focused mostly on value according to the word-count analysis. The prioritization shifted to attributes/features in R&D, design, and product strategy functions. These functions helped develop business cases and converted ideas into tangible product options. Thereby, R&D had the opportunity for interpretative flexibility to reinterpret customer value with a potential focus on the past rather than on the future. Overall customer value, product attributes/features became the vernacular of downstream communication about the product's internal definition and not a means to address specific ideas about how to respond to potential changes in the market.

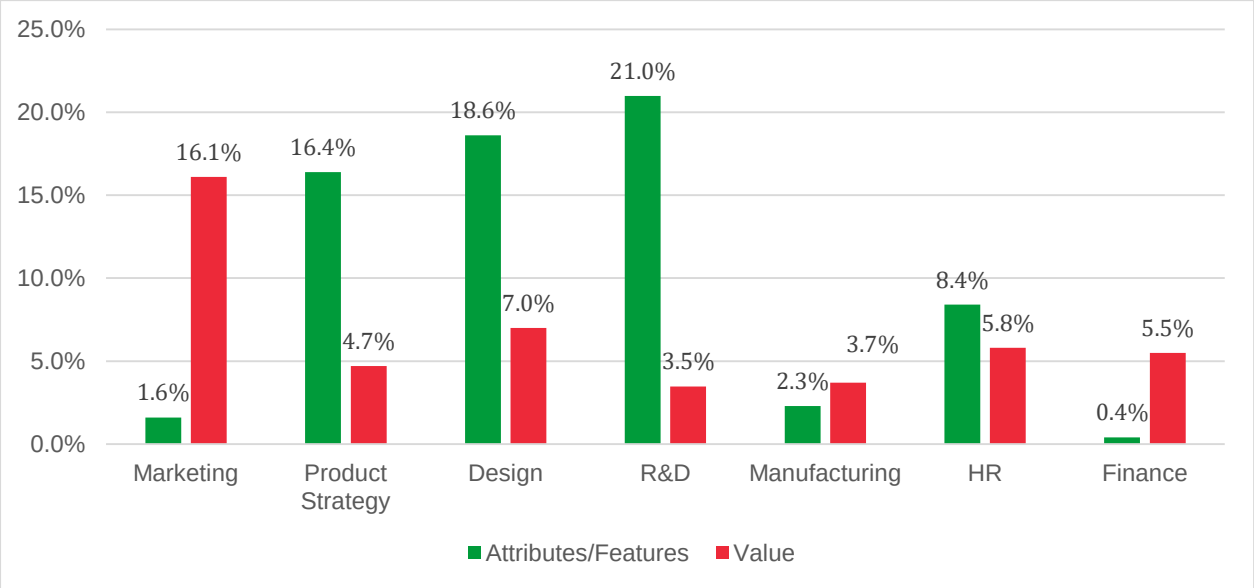

Figure 3. Frequency of the Words "Attributes"/"Features" and "Value" in Functions

These findings signal that the R&D function did not have clearly defined information about customer value in terms of attributes/features and service components at its disposal that would enable it to apply its understanding to a new product development.

To address asymmetric information related to customer value, 43 percent of the R&D respondents in the study mentioned their own initiatives to collect customer information directly in order to be better able to interpret customer value. We found that the R&D function engaged in this data collection to compensate for differences in perception to better deliver on attributes/features that aligned with customer value.

Next, we further analyzed the same word-count data but this time across all functions (see Figure 4). We found that the R&D function's focus on attributes/features and the marketing function's focus on value remained as pronounced as in the earlier word-crunch analysis in functions. In Figure 5, one can see that the R&D function's focus on attributes/features constituted 69 percent of all functions' focus on attributes/features, while the marketing function's focus on value constituted 67.8 percent of the total. As such, the pattern remained the same as in the previous analysis.

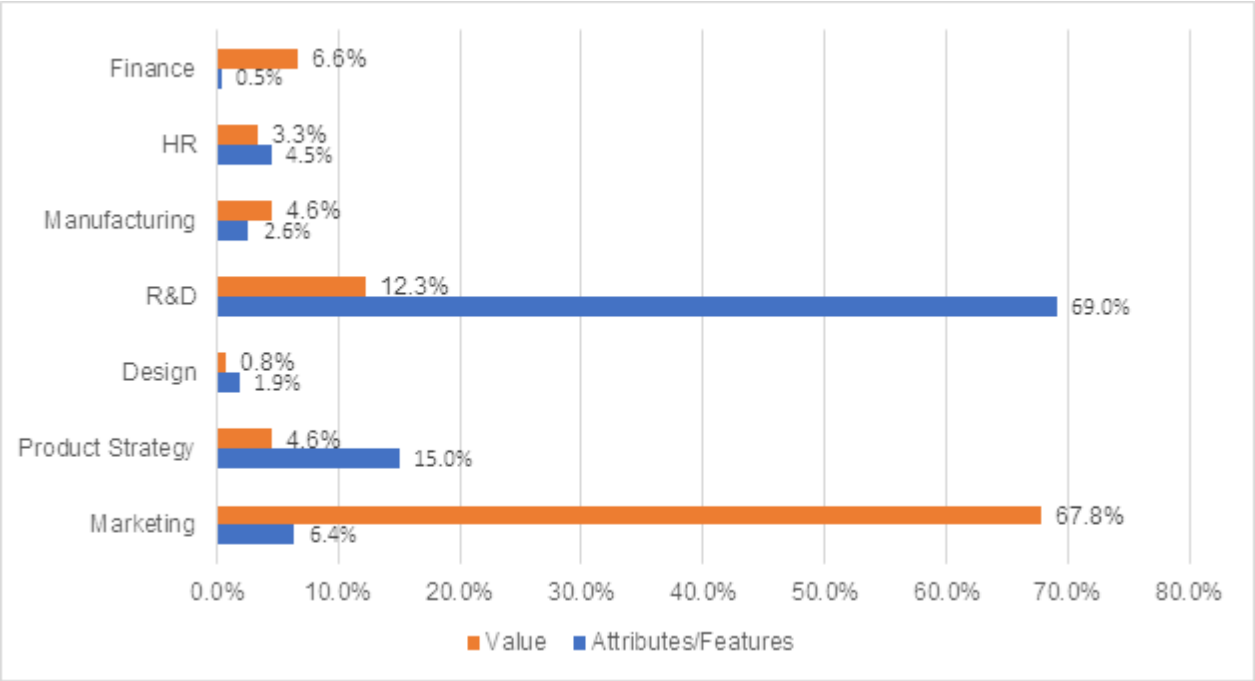

Figure 4. Frequency of the Words "Attributes"/"Features" and "Value" Across Functions

We found that the marketing function used customer value mostly for external communication. Hence, it served as a vehicle for the marketing function to communicate product-centric information from the ideation and revenue-centric functions in the development process. The fact that we found that customer value did not serve as an organizing principle to align perspectives and information flows across functions suggests significant differences in focus as the product moves from ideation, manufacturing to commercialization.

4.2.2 Inefficiency 4: Value Ambivalence

Studying how the organization used the value and product attributes/features concepts as a vehicle for sharing information, we continued to explore how potential responsibility and focus for value versus attributes/features varied in the organization across managerial layers (from senior vice president (VP) to operations) (see Figure 5).

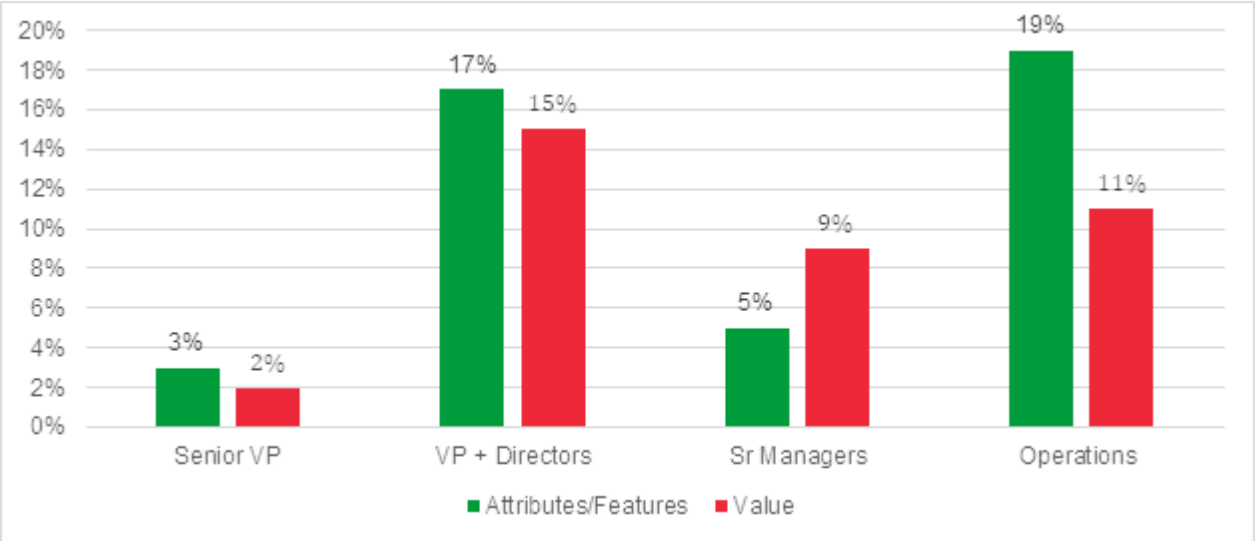

Figure 5. Use of Value and Attributes/Features by Organizational Role (%)

The word-count analysis shows that senior VPs used value and attributes/features the least often. We found that they evenly used the keywords customers, finance, cost, and business perspective, which together accounted for 75 percent of their interview data. On the other hand, VPs/directors and operations used value and attributes/features the most frequently, respectively, though the former used both words in a more balanced manner. We expected these differences given the variations in different stakeholders' perspectives. At the same time, Rolling Thunder operated in a market in which it had begun to transition from manufacturing to selling services, and one can reasonably expect that senior VPs would focus more on value and attributes/features. The word-count analysis further suggests that the difference in focus increased as we moved toward operations where the count on attributes/features dominated value, which shows the need to understand how to translate the conceptual ideas into concrete products and attributes.

4.3 Variety in Evaluation

4.3.1 Inefficiency 5: Distorted Responsibility

Analyzing the interview data, we used the unique code "balance" to capture when the respondents discussed balance or when their discussion concerned a balance between value and cost. In total, the words "value" and "cost" occurred in text analysis 262 times.

We interpreted the code balance as a proxy to measure stakeholders' responsibility to balance between value and cost. We found that, more than half the time it appeared, balance related to stakeholders from the R&D department. Interview data also indicate that the R&D function used the word cost most frequently. As expected, we also found that the finance function focused mostly profitability and the marketing function focused mostly on revenue. While these word frequencies merely indicate how functions in the organization perceived responsibilities and we did not subject them to any statistical testing, they nevertheless point to the differences in the way different functions in the organization view their responsibilities (see Table 8).

Table 8. Focus and Perceived Responsibilities (in %)

	Marketing	Product strategy	Design	R&D	Manufacturing	HR	Finance
Balance	5.1%	5.1%	2.0%	50.5%	12.8%	4.1%	20.4%
Cost	16.8%	8.4%	0.4%	28.9%	22.2%	3.6%	19.7%
Revenue	45.5%	9.1%	0.0%	9.1%	4.5%	13.6%	18.2%
Profit/profitability	13.9%	4.9%	0.0%	16.0%	9.7%	0.7%	54.9%

With regard to the different perspectives, respondents from the marketing and finance functions also used the word balance but with respect to the financial balance and their responsibility either in terms of profit or revenue. We also found that the marketing function used the word balance to describe the benefits of balancing profitability while preserving a balance in volumes and revenues and in the context of having to balance customer requirements with the NPD processes in the industrial system. Our findings show that the finance function was the most concerned with profitability and balancing revenue and cost.

The upstream functions (marketing and product strategy) used the word balance in relation to balancing different product functions and features to match customer requirements. According to the word-count analysis, these functions mainly focused on developing an attractive and competitive product and less on its cost. The following quote illustrates the respondents' focus on the early stages and less on realizing their "development order" and also on how marketing function pushed responsibility to elsewhere in the organization:

> *Yes, the biggest problem we have, without a doubt, it is this balancing of properties and getting the product together. But there is no universal costing attack approach. Almost every single gate you come to…, the product costs significantly more than what it may cost…. It is chronically so. We can, of course, slim down the contents of the product, so we are going through the gates. But it fits as well with the culture that it is more important that all properties are met than that we keep cost targets.* (Manager, R&D)

The significant differences in perceived responsibilities in different parts of the NPD process at Rolling Thunder indicate the potential challenges that organizations face in achieving set goals for new products in dynamic markets. Furthermore, these differences in perspectives and perceived responsibilities indicate misaligned stakeholder goals in the NPD process.

In the downstream functions, the R&D function took on the responsibility for balancing value (features and attributes that customers would pay for) and the cost of implementing it.

4.3.2 Inefficiency 6: Lack of Accountability

Rolling Thunder organized NPD activities in and around a project gate system to ensure that it could fulfill business and technical requirements at every stage in the NPD process. The organization used the system for formal planning and control but also to distribute accountability. Furthermore, the organization used the gate system to coordinate and communicate regarding actions that it needed to fulfill requirements. The deployed project gate system expressed all requirements as one of four statuses (initiated, preliminary, finalized, and verified) to help relevant process owners identify the project's current status. The project gate system reflects a metaphor in which fulfilled requirements constitute the key that opens specific gates to allow a project to proceed. When a project gate opens, it turns green, and the project can enter the next phase, but the gate remains red and closed when the organization has not met the necessary requirements.

The respondents spoke about the project gate system in two ways. All respondents used the gates to anchor how they described their roles, their specific work, and their cross-functional activities and communication(s). A majority of respondents also spoke about the gates as a system of control and/or accountability and, importantly, perceived the system as a rigid and reactive "old traditional control system". One of the more critical respondents questioned whether any company could ever successfully use a stage-gate system and indicated that Rolling Thunder did not represent an exception. Some other respondents indicated that it does not matter whether gates were red or green since people perceived that the gates did not matter for project control and decision making. The respondents stated the development costs typically exceeded the targets set that a lack of clarity in provided product specifications could explain. However, several respondents mentioned that, according to their experience, the organization had never stopped a project due to its gate status. Some respondents even laughed and said that they had never seen a green gate at the first gate evaluation. The standard operating procedure involved opening the gate with some reservation and looking for solutions in parallel. In highly prioritized cases, a management board that had to decide on the project's scope and intent had to address unmet requirements.

In situations with a rigid and poorly functioning formal project gate system with respect to accountability, organizations may follow informal solutions to be able to proceed with the necessary NPD activities. One solution involves working iteratively in a proactive way as the quotes below indicate:

> *There are a handful of people who work in the early stages. We know each other well, so it is iteratively everything. I must say that it is not as linear as it appears from a document covering the gate statuses.* (Senior/Vice President, Product Strategy)

> *I mean that the old way to sit and measure if a gate is red or green, it's a bit reactive. Then we will have some red or green [XX laughs] gates. It is better to be a few months ahead and be active and say, "Yes, what is it that we know we need to do", and so perhaps we will come closer to green than what we've done in the past. To measure that we are red, it gives nothing.* (Director, R&D)

As we mention above, cost overruns common occurred in the NPD activities at Rolling Thunder. In our research, we found that, in order for the processes to proceed (to pass the gate) in these situations, additional responsibility assignments occurred with a focus on cost reduction or to revise the business case for the project based on higher than previously forecasted costs. Since the gate system connected to activities in the development process, it also set the pace and cadence for the development organization. As one can see in Figure 6, the aggregated status of all gates shows that, when the project gate system assessed a large portion of gates as red with peaks early in the year, this state followed with a predictable lag before the project gate system assigned a new project threshold via re-gating and setting a new, later date.

From the pattern, we can see that the gate system in particular and lack of accountability in general created an arrhythmic work pace in the NPD process.

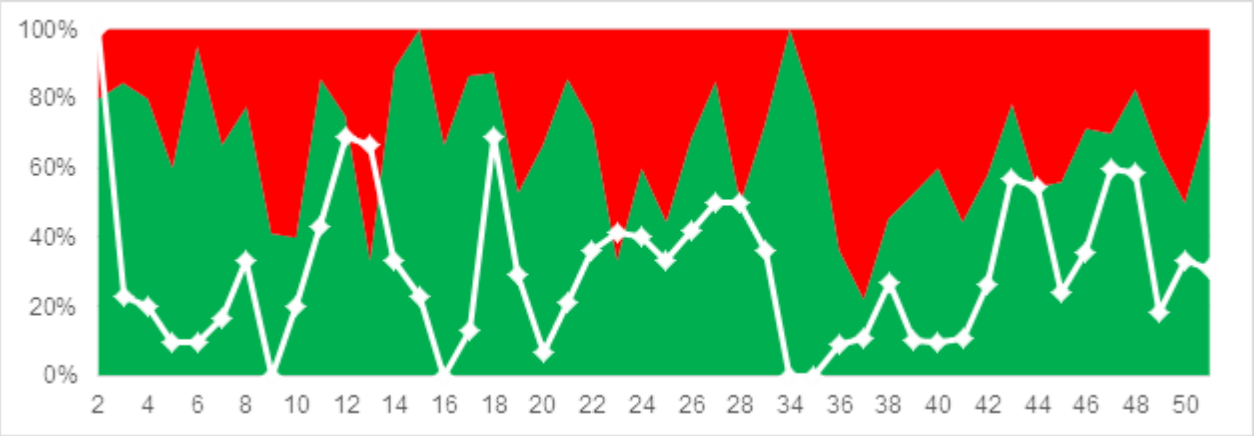

Figure 6. Overview of Weekly Aggregated Gate Status (n = 558 Gates for 2010-2013)[1]

5 Discussion

In Section 4, following the SCIS design characteristics that Hedberg and Jönsson (1978) presented, we examine how inefficiencies acted as destabilizers to instill Rolling Thunder with an increased variety of communication, perception, and evaluation. In this section, we focus on how our findings inform work that examines how organizations enact organizational ambidexterity.

5.1 Rolling Thunder as a Semi-confusing Information System

As we show in Section 4 and summarize in Table 9, Rolling Thunder displayed several SCIS design characteristics

Table 9. Summary of Inefficiencies and Examples of Repertoires

IE	Inefficiency (variety)	Description	Example of repertoires of unsanctioned behavior
IE1	Information gaps (communication)	Substantial gaps in terms of who has access to what information in the NPD process.	R&D conducted its own customer studies rather than re-using material from the market.
IE2	Asymmetric information flows (communication)	The flow of information does not align the NPD process's design	Functions disregarded the market as a source of information and de-prioritized feedback.
IE3	Conceptual fluidity (perception)	Organizational functions do not uniformly define core constructs for the NPD process.	Several functional areas increasingly discarded customer value as a construct further in the process, which allowed them to focus more sternly on attributes.
IE4	Value ambivalence (perception)	Organizational functions assign core constructs different emphasis throughout the NPD process.	Functions emphasized customer value differently depending on hierarchical layer.
IE5	Distorted responsibility (evaluation)	Organizational functions disregard formalized responsibility.	R&D balanced cost-functionality late in the process
IE6	Lack of accountability (evaluation)	Organizational functions disregard formalized accountability.	Functions conducted work iteratively and in parallel rather than sequentially, which disregarded the gate system.

[1] Green = proportion of gates passed according to plan; red = proportion of gates not passed according to plan. The white line represents the proportion of the green gates that were "re-gates" (i.e., gates with new, extended dates). We do not show data for week 30 and 32 due to national holidays at the time.

In terms of variety in communication, we found that insufficient formal support (management control system, Knowledge Management system, NPD system, etc.) created significant information gaps, which represented a direct inefficiency for Rolling Thunder. From the alternative perspective, the information gaps resulted in the necessity for localized knowledge and organizational capabilities associated with sensing (Eriksson, 2014; Helfat & Raubitschek, 2018; Teece, 2010; Teece, Peteraf, & Leih, 2016). In this situation, the organization responded to information gaps by equipping itself with more dynamic capabilities over time, which increased its ability to act without formal information. Said capabilities allow an organization to manage radical flux in the market with rapidly changing customer demands (Cheng & Kesner, 1997). One can find a similar approach in asymmetric information flows' design characteristics. Here, feedback's (rather than feedforward's) dominance signifies interactive control (Müller-Stewens, Widener, Möller, & Steinmann, 2019; Simons, 1994) in which the lack of information from previous stages in the process results in a continuous dialogue. In this dialogue, situational awareness becomes heightened as work transgresses traditional silos.

In terms of variety in perception, design characteristics in relation to conceptual fluidity seen through the lack of a uniform definition of customer value simultaneously creates possibilities for interpretative viability (Benders & Van Veen, 2001) in the NPD process. With functional specialization in the workforce and tasks assigned throughout the process, the imposition of a uniform definition, syntax, and taxonomy of customer value would do little to avoid the necessary inter-functional translation. Domain-specific knowledge (Xiao, Zhang, & Basadur, 2016; Eriksson, 2014) had a critical role in each function and an invariable association with its own particular language. Value ambivalence functioned in the same manner with the dominant perspective being attributes rather than value as a core construct. By allowing functions to use domain-specific language internally, Rolling Thunder would have created opportunities to accept its functions' different perspectives rather than attempting to overrule them with corporate language about customer value.

In terms of variety in evaluation, we found biased responsibilities in cost-value balancing practices. By pushing responsibility for balancing costs and value to the R&D and manufacturing functions, the organization created the potential for more creativity in the NPD process's earlier stages. In other words, cost replaced value as a core construct the further down the path to a new product the organization went. Although the increased leeway that this replacement offered the marketing, strategy, and design functions represents an inefficiency, one can see it as a safeguard against reality's imposing on the organization's efforts to ideate and conceptualize a new product (see Berente, Lyytinen, Yoo, & King, 2016; Yeow, Soh, & Hansen, 2018), which our findings about the poor accountability for failures in the process reflect. A function received no immediate repercussions for failing to balance cost-value, nor did such failure lead the organization to pause the NPD process. Instead, the functions continuously addressed unresolved issues in earlier stages of the process as it progressed. As a result, we found an environment in which functions continuously re-examined potential faults in the product as they emerged and did not risk losing face if they failed to deliver on time. In other words, the lack of accountability created increased flexibility over time (Berente et al., 2016; Abdulkadiroglu, Angrist, Dynarski, Kane, & Pathak, 2011).

5.2 How SCIS Informs Studies on Ambidexterity

We identified multiple inefficiencies in the NPD process's setup (see Table 9). However, based on the SCIS perspective, we can see these inefficiencies as features and not bugs. The inefficiencies drove unsanctioned behavior (to circumvent shortcomings in the formal governance), which, in turn, drove variety and, hence, SCIS compliance (i.e., level of correspondence with the SCIS's design characteristics). As a result, Rolling Thunder enacted ambidexterity in a more decentralized way, which may have resulted in its re-allocating resources from exploitation to exploration (based on the theoretical assumption that exploration and exploitation constitute the sole parts of the whole (March, 1991)). As an example, in IE5, a respondent from the R&D function highlighted that, rather than slimming down content in order to meet the budget gate, the organization allowed the properties to take precedence over the costs. Thus, employees circumvented the formal control (gate system) designed for exploitation in order to re-allocate costs to finding the right new solutions (i.e., exploration). Based on previous findings (Luger et al., 2019; Zimmermann et al., 2019), decentralized enactment and decreased allocation to exploitation impact an organization's ambidexterity both in balance and in enactment. We present the relationship between inefficiencies and ambidexterity that we identified in Figure 7.

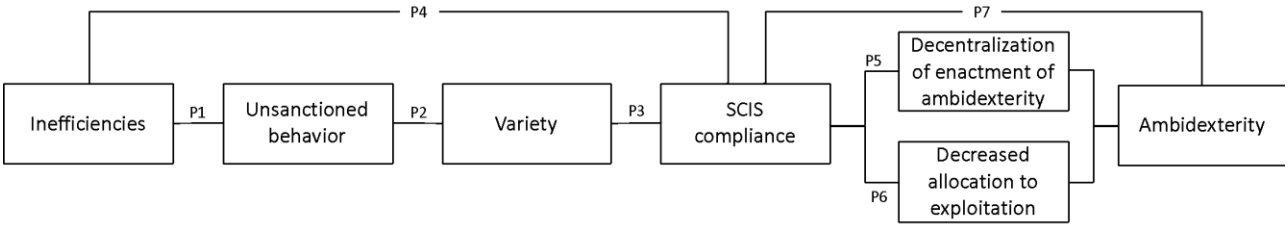

Figure 7. Overview of Relationship Between Inefficiencies and Ambidexterity

Based on our findings, we offer four propositions for future research.

P1: There is a positive relationship between inefficiencies and new repertoires of unsanctioned behavior in an organization.

The first proposition stems from our identifying variation in behavior attributable to inefficiencies. Researchers have identified inefficiencies as slack (Mousa et al., 2017; Stock et al., 2018) and shown them to positively influence unsanctioned behavior and drive innovation (Lungenau, Stern, & Zajac, 2016). As Magnusson, Koutsikouri & Päivärinta (2020) have shown, much total innovation occurs in control's shadow (i.e., employees enact it in the form of shadow innovation).

P2: There is a positive relationship between new repertories of unsanctioned behavior and increased variety.

The second proposition concerns how unsanctioned behavior drives variety in operations associated with NPD. Here, we found that sanctioned behavior streamlines operations, whereas unsanctioned behavior drives diversity and variety in both approaches, solutions, and workarounds (Berente et al., 2016).

P3: There is a positive relationship between increased variety and increased SCIS compliance.

The third proposition concerns the relationship between variety and SCIS compliance in line with Hedberg and Jönsson's (1978) theoretical work.

P4: There is a positive relationship between the degree to which an organization complies with SCIS characteristics and its inefficiency level.

The forth proposition attributes a direct relationship between SCIS compliance and inefficiency level. Here, we propose that the higher inefficiency in a process, the higher the SCIS compliance, which turns the latter into a measure that will have different optima for different organizations.

These empirically grounded propositions raise two key issues for research that examines ambidexterity. The first issue concerns the balance between exploitation and exploration as Zimmermann et al. (2018) and Luger et al. (2018) have noted. Zimmermann et al. (2018) stated that design and configuration provide different perspectives on ambidexterity with previous studies mainly focusing on the design perspective. They argued that their empirical work points toward ambidexterity not being an issue for senior managers to design but rather for front-line managers to enact (i.e., configure). Thus, by necessity, employees on the front line need to balance exploitation and exploration when enacting ambidexterity as best they can. Our findings from Rolling Thunder support this finding. In Rolling Thunder, employees and different teams enacted ambidexterity via constantly balancing exploitation and exploration in that they often circumvented less-than-optimal formal control systems and allocated resources via micro-level misalignments rather than via strategic intent (i.e., aligned). As Berente et al. (2016) and Yeow et al. (2018) have noted, to enact ambidexterity in this way, employees need certain freedom in control. Accordingly, the degree to which an organization complies with SCIS design criteria becomes a measure of how de-centralized balancing is (i.e., its configurational level (Zimmermann et al., 2018)). Hence, we offer a fifth empirically grounded proposition:

P5: There is a positive relationship between the degree to which an organization complies with SCIS and the degree to which it enacts ambidexterity in a de-centralized manner

This decentralization of ambidextrous balancing also has a central role in recent findings on the management of digital innovation (Nambisan, Lyytinen, Majchrzak, & Song, 2017), where the decentralization of general mandate is seen as core. As we can see in Svahn et al.'s (2017) work on the

automotive industry, organizations require this de-centralization to tackle the challenges associated with an increased need for digital innovation in automotive organizations.

The second issue concerns the boundaries between exploitation and exploration, which Stokes et al. (2015) have also highlighted. If an organization enacts ambidexterity primarily to avoid the reported tradeoffs between exploitation and exploration, then we need discriminant definitions for how to approach the phenomenon empirically. We show that Rolling Thunder's NPD process contained inefficiencies and that these inefficiencies were associated with repertoires that re-allocate resources towards increased variety, i.e. decreased efficiency. Hence, the boundaries are semi-permeable and fluid, provided SCIS design criteria are followed, and we can derive a sixth empirically grounded proposition:

P6: There is a positive relationship between the degree to which an organization complies with SCIS and its decreased allocation of resources to efficiency.

Finally, the level of compliance with SCIS design criteria becomes a measure of how fluid the boundaries between exploitation and exploration are (i.e. how dynamic the balancing of ambidexterity is). This results in the seventh (theoretically grounded) proposition for future research:

P7: There is a positive relationship the degree to which an organization complies with SCIS and the degree to which it dynamically balances ambidexterity.

As Luger et al. (2018) have noted, an organization that acts in an environment with shifting dynamism levels needs to be able to both balance and re/unbalance in order to stay ambidextrous. A certain level of balance between exploitation and exploration invariably leads to inertia, which means an organization needs capabilities to break the existing balance. The identified inefficiencies act to ensure that an organization allocates sufficient resources toward exploration rather than exploitation over time. If an organization incorporate inefficiency into its NPD process, it has time for reflection and re-interpretation and, perhaps foremost, micro-mistakes and continuous reconfiguration (Zimmermann et al., 2018). Variety in communication, perception, and evaluation increases the pluralism of ideas, which slows the NPD process and makes it more likely to result in minor glitches. At the same time as it increases the risk on the micro level, it also decreases the risk at the macro level (Luger et al., 2018). When an organization constantly re-orients itself based on variety, it can expect that it will decrease the risk that it will create a product that consumers do not demand or expect.

5.3 Future Research

We see two main avenues for future research from this study. First, our identifying inefficiencies as central tenets in ambidexterity enactment introduces a potential new approach for ambidexterity research. Following the configurational approach that Zimmerman et al. (2018) advocated and Luger et al.'s (2018) dynamic ambidexterity approach, we see enactment as we describe in this study as inspiration for future studies that examine "how" rather than "what" (Wiener et al., 2016). Ambidexterity research has a tendency to strive for normative findings in relation to configurations for ambidexterity (Birkinshaw et al., 2016; Raisch & Birkinshaw, 2008; Heracleous, Yniguez, & Gonzalez, 2018) rather than looking more intently at how organizations actually balance exploitation and exploration over time. We hope that the notion we propose about inefficiencies as tenants in ambidexterity enactment may offer a novel approach for future studies, which could use Propositions 5 to 7 as a basis.

Second, we see a more nuanced understanding of inefficiencies as a stepping stone for a wide range of new research questions. When, for instance, does an inefficiency merely constitute an inefficiency and not a mechanism for an organization to enact ambidexterity? How can we differentiate between different types of inefficiencies and move towards a typological theory of inefficiencies? We hope that these and similar questions may inspire future research.

5.4 Implications for Practice

Our research has three main implications for practice. First, organizations intent on conducting major transformation initiatives such as the one in Rolling Thunder should use the findings that we present here with caution. For organizations similar to Rolling Thunder with a dominant engineering culture (Kunda, 2009), many "best practices" that would solve the inefficiencies we identified. An organization could find itself in the process of eliminating all the inefficiencies to create an optimized NPD process. According to our experience at Rolling Thunder, doing so would most likely constitute a mistake. The informal controls that emerge in situations without formal controls often function as safeguards for innovation, encourage

dialogue, shift responsibility and accountability, and so on. In this instance, the engineering approach to increase efficiency could risk overriding control elements that an organization's innovation capabilities require. From this perspective, an organization that increased the NPD process's efficiency could risk decreasing its ambidextrous capabilities, which would result in a tradeoff between innovation and efficiency (Luger et al., 2018; Zimmermann et al., 2018).

Second, our study highlights the role of individuals rather than formal controls for executing strategy. In lieu of the strategy-as-practice movement (Whittington, 1996), formal control's failures at Rolling Thunder emancipated employees in executing strategy. In this respect, individuals and not the organization as such enacted ambidexterity, which re-frames ambidexterity from an organizational to an individual task. Managers who work in similar environments should consider how varying degrees of freedom support this enactment. In line with Zimmerman et al. (2018), enactment places additional emphasis on frontline employees rather than on the senior management in ambidexterity.

Third, for organizations that want to enhance their innovation capabilities, our study hints at a structured manner in which they could do so. In order for an organization to dynamically balance exploration and exploitation, it should consider said design characteristics as potentially valuable and not something that it should avoid.

5.5 Limitations

The study has two main limitations. First, conducting a secondary qualitative data analysis as we did always comes with caveats. As Heaton (2008) has noted, secondary data analysis suffers from problems associated with data fit, not having been there, and verification (i.e., statistical generalizability). Among these problems, we single out data fit as the more significant problem. We collected the original data to conduct an explorative case study and did not aim for statistical generalizability. As for the data fit problem, we believe that using the inefficiencies that the original study targeted as the basis for a secondary data analysis warrants a sufficient data fit. Second, the single case approach we used limits our ability to generalize our findings—a well-known and researched phenomenon. In line with Eisenhardt and Graebner (2007) and Flyvbjerg (2006), we argue that that such logic represents a misunderstanding in that researchers have equated theoretical generalizability with statistical generalizability. In our study, we do not rely on statistical generalizability to verify our findings.

Second, the type of organization we selected creates limitations related to transferability and generalization. As we note in Section 3.1, the automotive industry is undergoing disruptions in several areas such as digital transformation, electric vehicles, and so on (Svahn et al., 2017; Bohnsack, Pinkse, & Kolk, 2014). We conducted our study at a time when these changes posed a significant issue and had significant implications (Vial, 2019) for the future practice and evolving business models. We did not specifically study these changes on the NPD process but rather studied the NPD in its current form. While Rolling Thunder had just begun its journey of embracing industry changes at the time of this study, we did not study the industry dynamics as a separate variable.

6 Conclusions

Through applying the SCIS design characteristics that Hedberg and Jönsson (1978) have offered as a framework and based on recent findings from the organizational ambidexterity field (Luger et al., 2018; Zimmermann et al., 2018), we explore the role that inefficiencies play in the enactment of ambidexterity. We found that, rather than solely hindering an organization's performance over time, inefficiencies function as destabilizers such that they positively influence the dynamic balance between exploitation and exploration and decentralize this balance to the organization's front line. Thus, in the future, researchers need to study inefficiencies not as bugs but rather as potential features that could help organizations enact ambidexterity. We present seven propositions for future research that we hope researchers interested in further studying ambidexterity will find valuable.

Acknowledgements

We express our sincere thanks to the Marianne and Marcus Wallenbergs Foundation, Stena AB, the MIT Research School, and, the Söderberg Foundation for the monetary support necessary to conduct this research. We also thank Jonas Jakobsson for participating in the original empirical work and the respondents at Rolling Thunder.

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